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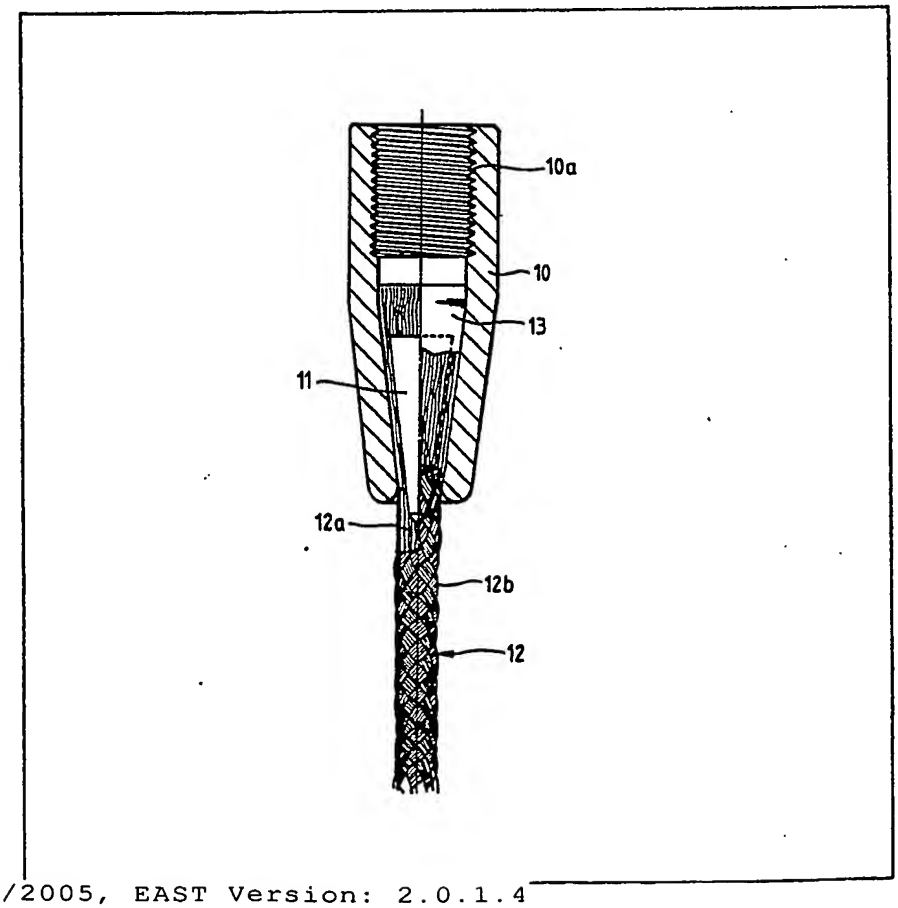
(54) Rope end fitting

(57) The fitting comprising a housing (10) with a tapered bore and an interfitting cone (11), is emplaced by threading the rope onto the housing, splaying out the end fibres thereof, introducing the cone centrally among the fibres and withdrawing the rope until the cone grips the fibres within the taper. This is done in such a manner as to leave fibres projecting beyond the cone, e.g. by 10 mm. A fluid epoxy resin is then introduced to these fibres and cured to form a plug which may be contiguous with the rear of the cone.

For ropes to be subjected to high shock loading the end fitting and rope assembly is given a preload of rope proof stress proportions to establish that friction is the principal load transfer medium in the end fitting.



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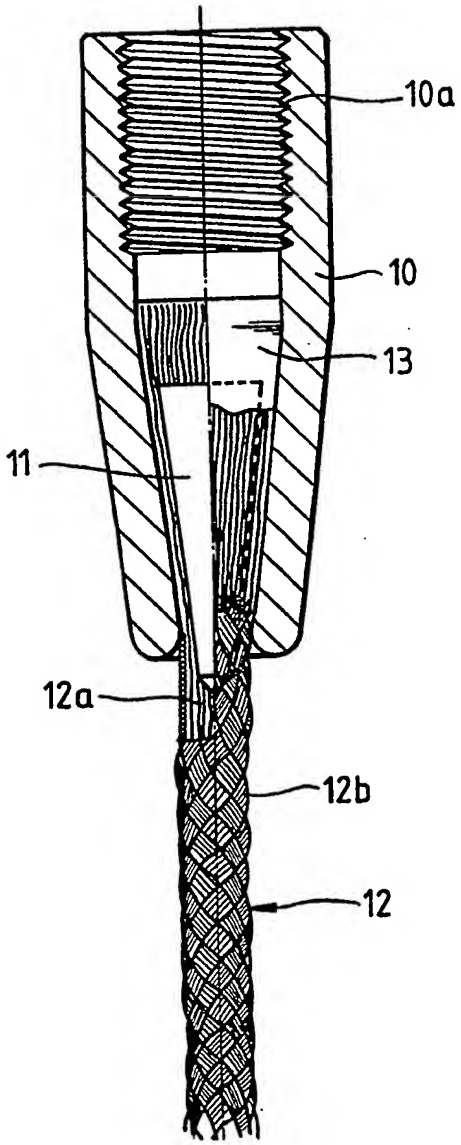
10a
10
13
11
12a
12b
12

SPECIFICATION

Rope end fittings

The present invention relates to end fittings for ropes, particularly for ropes made of such high modulus plastics fibres as Kevlar (Registered Trade Mark) when they are likely to be subjected to high shock loads.

UK Patent Specifications 1139841 and 1341013 describe rope end fittings which basically comprise an attachment housing having a bore tapering toward the rope, and a conical bullet arranged to fit inside the said bore, whereby a rope can be threaded through the bore and the fibres thereof splayed out, the bullet can be introduced centrally amongst the fibres and the rope with the bullet drawn into the housing until the rope is gripped between the bullet and the bore. In the former patent specification the fitting comprises also a tapered collar which assists in the gripping.

It is also known to use on high modulus fibre ropes an end fitting comprising an attachment housing having a conical bore and to encase the splayed fibres in a low modulus resin in situ in the housing.

None of these known end fitting arrangements have been found satisfactorily to transmit all the forms of tensile loading a high-modulus plastics fibre rope is able to withstand.

The present invention provides an end fitting capable of transmitting all the forms of tensile loading the rope is able to withstand.

According to the present invention a method of attaching an end fitting to a rope comprises

introducing an end of the rope into a housing having a conical bore tapering down toward the body of the rope, the end of the rope consisting of fibres parallelised in the axial direction of the rope,

introducing into the housing centrally of the fibres a cone of suitable taper so that the fibres project somewhat rearward of the base of the cone,

drawing the fibres, and the cone, through the housing under tension of manual proportions,

introducing into the housing behind the cone base a fluid resin in such a manner as to ensure full wetting of the projecting fibre by the resin, and

curing the resin.

Preferably the cone is made of nylon or material of similar resilience thereto and is bullet nosed, and has a taper such that the annular cross sectional area between the cone and the housing is substantially constant.

According to a feature of the invention the method may comprise a further step of applying a sufficient tensile pre-load between the rope and the end fitting to establish that friction between the rope fibres and the tapered surfaces of the end fitting members is the principal load transfer mechanism. The preload may be of the order of the proof load of the rope.

High modulus rope, with which the invention is especially concerned, comprises a load bearing core of fibres substantially axially aligned and a protective sheath of woven fibres, the latter being chosen for their weather proofing and their abrasion resistance rather than their end fitting the sheath may be cut away. Alternatively it is unwoven and the fibres thereof splayed out with those of the core.

The angle of the bore and cone tapers, which is preferably similar, may be between 10 and 20°. The amount by which the fibres are arranged to project rearwardly of the cone after the first tensioning is preferably between 5-10 mm. The resin, which may be an epoxy resin, is preferably fluid at room temperature and is arranged fully to impregnate the projecting fibres by use of a wetting agent, or agitation, or both, so that no cavity of any substance is left in the resin or between the latter and the cone.

An end fitting and the method of application thereof to a rope will now be particularly described, by way of example, with reference to the accompanying drawing, which shows a completed end fitting assembly.

The end fitting shown in the drawing comprises a cylindrical housing 10 and a solid cone 11. The housing 10 has an axial bore of which a forward part tapers down toward the end and a rearward part formed with a screw thread 10a for attachment to an anchorage. The cone 11 has a taper such that between it and the housing 10 the annular cross sectional area over the housing length of the cone remains constant. The cone 11 is bullet-nosed.

In order to effect an end fitting on a rope 12 having a core 12a of fibres aligned substantially axially and a protective braid sheath 12b, the rope is fed into the housing and the braid at the end of the rope is unwoven. All the rope end fibres are then splayed out and the cone 11 introduced centrally thereof. With about 10 mm of fibre projecting rearwardly of the cone the rope 12 is drawn into the housing 10 by a tension of manual proportions until the fibres are gripped between the cone and the housing. Then a fluid epoxy resin is introduced behind the cone, agitated to ensure full wetting of the fibres, and cured to form a plug 13 not significantly permeating the fibres and contiguous with the cone 11.

If the rope and end fitting combination is to be subjected to a high shock load a preload is applied to the combination, of such magnitude as to free the plug 13 from any temporary adhesion to the housing 10 and to draw the cone 11 and the plug 13 with the associated rope fibres, even more tightly into the housing, and to establish friction as the principal load transfer medium between the rope and the end fitting.

In a particular example of an end fitting on 10 mm Kevlar (TM) rope the housing 10 is formed of L65 aluminium alloy and is 9 cm long with a 14° taper extending for half its length, and a wall thickness of 7 mm. The cone 11 is made of nylon and is 40 mm long.

CLAIMS

1. A method of attaching an end fitting to a rope and comprising

introducing an end of the rope into a housing having a conical bore tapering down toward the body of the rope, the end of the rope consisting of fibres parallelised in the axial direction of the rope,

introducing into the housing centrally of the fibres

aper so that the fibres project

somewhat rearward of the base of the cone,

drawing the fibres, and the cone, through the housing under tension of manual proportions,

introducing into the housing behind the cone base a fluid resin in such a manner as to ensure full wetting of the projecting fibre by the resin, and

curing the resin.

2. A method as claimed in claim 1 and wherein the cone is made of nylon.

3. A method as claimed in claim 1 or claim 2 and wherein the cone is bullet-nosed.

4. A method as claimed in any one of claims 1 to 3 and wherein the cone has a taper such that the annular cross sectional area between the cone and the housing is substantially constant.

5. A method as claimed in any one of the preceding claims and comprising the further step of applying a sufficient tensile preload between the rope and the end fitting to establish that friction between the rope fibres and the tapered surfaces of the end fitting members is the principal load transfer mechanism.

6. A method as claimed in claim 5 and wherein the preload is of the order of the proof load of the rope.

7. A method as claimed in any one of the preceding claims and wherein the angle of the bore and cone tapers in between 10 and 20°.

8. A method as claimed in any one of the preceding claims and wherein the angle of the bore and cone tapers is similar.

9. A method as claimed in any one of the preceding claims and wherein the resin is an epoxy resin.

10. A method as claimed in any one of the preceding claims and wherein the resin is of a type which is fluid at room temperature and is arranged fully to impregnate the projecting fibres by use of a wetting agent, or agitation, or both, so that no cavity of any substance is left in the resin or between the latter and the cone.

11. A method of attaching an end fitting to a rope substantially as hereinbefore described with reference to the accompanying drawing.

12. A rope having an end fitting applied substantially as thereinbefore described with reference to the accompanying drawing.

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